**Myopericarditis and Sudden Cardiac Death Due to Physical Exercise in Male Athletes**

Zijad Duraković, Marjeta Mišigoj-Duraković, Josip Škavić and Andrea Tomljenović

1 Institute for Anthropological Research, Zagreb, Croatia
2 Department of Kinesiological Anthropology, Faculty of Kinesiology, University of Zagreb, Croatia
3 Department of Forensic Medicine and Criminology, Faculty of Medicine, University of Zagreb, Croatia

**ABSTRACT**

In the period 1998–, we registered four sudden and unexpected cardiac deaths in male athletes due to myopericarditis during or after physical exercise. Three of them were professional soccer players and the fourth was engaged in swimming. One aged 29, had symptoms of tiredness, heart enlargement and left ventricular premature beats during training. Three of them, aged 17–18–18, were without symptoms. Three died during training and the fourth died in the hospital after head trauma at training. In the first one, aged 29, forensic autopsy showed chronic myopericarditis, thickening of the left ventricular wall of 15 mm and enlargement of the whole heart. The second one, aged 17, had subacute diffuse myopericarditis, suppurative tonsillitis and narrowed ascending aorta. The third, aged 18, had chronic myopericarditis and cardiac aneurysm of the left ventricle. The fourth, aged 18, had fibrinous pericarditis, thickening of the left ventricle 20 mm, hypoplastic ascending aorta, bilateral bronchopneumonia and cerebral contusion with edema. In Croatia, death rate among athletes, including all its causes, reached 0.15/100,000, in athletes suffering from myopericarditis it was 0.34/100,000, in others who practice exercise recreatively it amounted to 0.57/100,000 (p=0.0068), and in all males who practice exercise it measured 0.75/100,000 (p=0.0014). Physical exercise has to be contraindicated in cases of myopericarditis for at least six months from the onset of the illness.

**Key words:** male athletes, physical exercise, myopericarditis, sudden cardiac death

**Introduction**

Regular physical exercise, controlled and adapted to physical condition of the organism, has beneficial effects surpassing hazards. In healthy persons health related incidences are rare, as well as sudden death. Persons engaged in recreational physical exercise are protected from various diseases by such regular activities. In those under 30 years who have died suddenly during or after physical exercise the most common causes are cardiovascular diseases.

The aim of the study is to analyze different degrees of myopericarditis and their consequences as the cause of sudden death during physical exercise in young persons engaged in sport or recreative physical exercise.

**Sample and Methods**

The presented data are a part of a large retrospective study analyzing 57 sudden and unexpected deaths in Croatia due to or after sport or recreational exercise in a period of 10 years: from 1998 to 2007, including all ages and both sexes. The data were collected from the whole population consisting of 4,500,000 people. Seven of them were athletes and 50 were exercising recreatively. The deceased persons were found in the registry of the Forensic Medicine Services, the Public Health Registry and sports clubs. In that period, we detected four deaths due to myopericarditis in males aged 17–29. Three of them died suddenly due to physical exercise and one died after physical exercise in a hospital because of complications. One was engaged in swimming and three were pro-
Results

The data of four cases: three athletes and one included in recreative physical exercise, are presented in Table 1. The first, aged 29, was a professional soccer player who had clinical signs of heart enlargement and frequent left ventricular premature beats. He refused to follow the physicians’ advices to stop with competitive matches. During a game, he suddenly felt ill and collapsed. He was resuscitated, transferred to the nearest hospital but died in transit. Forensic autopsy showed chronic myopericarditis, thickening of the left ventricle of 15 mm, and enlargement of the whole heart.

The second, aged 17, was a school boy and professional soccer player with no data of any subjective complaints during physical exercise. He died suddenly during a game. He was unsuccessfully resuscitated at the field. The forensic autopsy finding was subacute diffuse myopericarditis, narrowed ascending aorta (10 mm), and suppurative tonsillitis.

The third one, aged 18, was a school boy with no data of any subjective discomfort during physical exercise. He died suddenly during swimming. Resuscitation was useless. Forensic autopsy showed chronic myopericarditis and cardiac aneurysm of the left ventricle.

The fourth athlete, aged 18, was a school boy and professional soccer player. He did not complain of any troubles during physical exercise. During a soccer game, one player kicked him in the head with a ball. At that moment he felt general weakness with short breath and fell down. He was transferred to the nearest hospital, where he died two days upon admittance in spite of all therapeutic efforts. Forensic autopsy showed fibrinous pericarditis, large bilateral pneumonia, cerebral contusions with edema and pointed bleeding, hypoplastic ascending aorta and biventricular hypertrophy. The left ventricular wall measured 20 mm, indicating hypertrophic cardiomyopathy. The right ventricular wall measured 4 mm. The heart weight was almost double than normal, amounting to 450 g.

Discussion

The article explores the aspects of interrelationship between physical exercise and different types of myopericarditis in young male athletes. In athletes who died suddenly during exercise, the most common causes of such events are cardiomyopathies, coronary anomalies and myocarditis. Sometimes it is not easy to clinically distinguish physiological myocardial hypertrophy from hypertrophic cardiomyopathy. Normal values of ventricular thickness are up to 11 mm, borderline values between 11 and 15 mm, but thickening above 15 mm implies criteria for hypertrophic cardiomyopathy. In the Veneto Region, myocarditis was at the third place as the cause of death in athletes during physical exercise reaching up to 7.5% (12). In our study the rate was 0.34/100,000 compared to 0.15/100,000 in young athletes who died due to all cardiac reasons during exercise. In our general population aged 15–40, who practice recreative physical exercise the death rate reached 0.75/100,000, with statistically significant difference (p=0.0014). This means that there is practically no probability for the dif-

<table>
<thead>
<tr>
<th>Case</th>
<th>Age</th>
<th>Physical exercise</th>
<th>Symptoms</th>
<th>Physical finding</th>
<th>Lethal event</th>
<th>Resuscitation</th>
<th>Forensic autopsy</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>29</td>
<td>professional soccer player</td>
<td>tiredness during training</td>
<td>heart enlargement, ventricular premature beats</td>
<td>during a game</td>
<td>yes</td>
<td>chronic myopericarditis, heart enlargement left ventricular wall 15 mm</td>
</tr>
<tr>
<td>2</td>
<td>17</td>
<td>professional soccer player</td>
<td>no</td>
<td>no data</td>
<td>during a game</td>
<td>yes</td>
<td>subacute diffuse myopericarditis, suppurative tonsillitis, narrowing of the ascending aorta to 10 mm</td>
</tr>
<tr>
<td>3</td>
<td>18</td>
<td>swimming</td>
<td>no</td>
<td>no data</td>
<td>during swimming</td>
<td>yes</td>
<td>chronic myopericarditis, cardiac aneurysm of the left ventricle</td>
</tr>
<tr>
<td>4</td>
<td>18</td>
<td>professional soccer player</td>
<td>no</td>
<td>no data</td>
<td>in a hospital 2 days of admission after trauma of the chest</td>
<td>yes</td>
<td>fibrinous pericarditis, hypoplastic ascending aorta, thickening of the left ventricle: 20 mm, bilateral broncho-pneumonia, cerebral contusion with edema, ventricles: left 20 mm and right 4 mm, hypoplastic ascending aorta</td>
</tr>
</tbody>
</table>
ference to be caused by chance alone. Athletes obviously are protected from cardiovascular events.

Myopericarditis could lead to malignant ventricular arrhythmia and sudden cardiac death. Acute viral infections of the upper respiratory tract can diminish isometric myocardial strength for 15%\(^{14-15}\). In such cases, diminution of enzymatic myocardial activity\(^{16}\) and abnormality of myocardial structure could be detected by electronic microscopy in samples of repeated myocardial biopsies.

Physical exercise is contraindicated in different types of myopericarditis for at least six months. When to restart training depends on the disappearance of subjective symptoms, on the normalization of clinical state and biochemical parameters, i.e. double viral titers, on the normalization of electrocardiographic finding in a 24-hour electrocardiogram, and on electrocardiographic and echocardiographic scans at rest and during exercise (stress). Sometimes in specific cases other procedures are needed: radionuclide studies, cardiac catheterization and magnetic resonance imaging.

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**REFERENCES**